Cole-Parmer Instrument Company

Manufactured by: **Barnant Company**

SERVICE MANUAL

MODELS:

75211-30 Console, 115 Vac, 60 to 3600 r/min
75211-35 Console, 230 Vac, 60 to 3600 r/min
75211-40 NEMA Modular, 115 Vac, 60 to 3600 r/min
75211-41 Controller only
75211-42 Motor only
75211-45 NEMA Modular, 230 Vac, 60 to 3600 r/min
75211-46 Controller only
75211-47 Motor only

PROPRIEARY

Information contained in this manual is proprietary to the BARNANT COMPANY, division of COLE-PARMER INSTRUMENT COMPANY, INC. No reproduction for other than the intended use of maintaining the product described herein is permitted without the permission of BARNANT.

TABLE OF CONTENTS

Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com

INTRODUCTION

Service for this product is performed at three levels: the customer, distributor/COLE-PARMER and factory/depot repair. This manual describes distributor/COLE-PARMER service procedures.

Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com

Customer service procedures are described in the operator's manual. Customers are encouraged to perform service as described in the operator's manual as well as in special circumstances where special skills and safety are not considerations.

To use this manual, begin with the troubleshooting section to isolate the fault to a replaceable part. The functional description and check-out procedure sections are also helpful in determining the faulty part. Distributor/COLE-PARMER repair is limited to replacement of modules as detailed in the replacement parts list section. The repair procedures section details disassembly and assembly procedures. After repair, the product should be calibrated and checked for proper performance.

Please refer to the operator's manual for:

A) Applications Data

B) Product Description

C) Installation

D) Setup

E) Operation

F) User Calibration

G) User Troubleshooting & Maintenance

H) Accessories

I) Specifications

SAFETY CONSIDERATIONS

Servicing must be performed only by personnel trained and skilled in the methods of troubleshooting and repair of electromechanical products. Use of procedures other than those described in this manual may result in a safety hazard to service personnel and/or customers.

Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com

WARNING: High voltage is present inside the unit, when servicing any component of this unit be absolutely certain that all power to circuitry is removed. If any functional checks are to be performed while power is applied and chassis is disassembled, care must be exercised.

CAUTION:

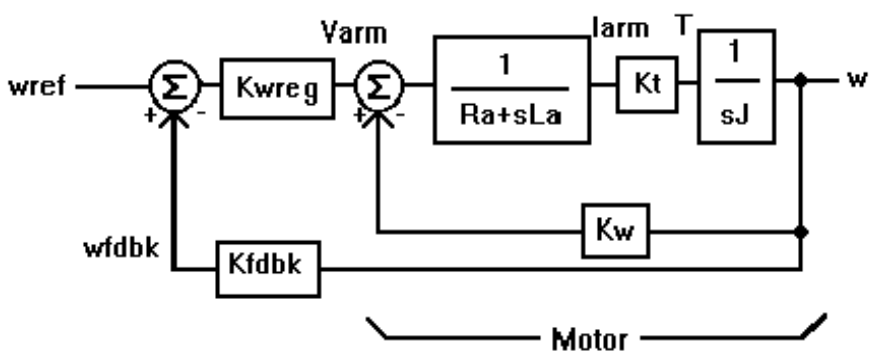
A.) This is a line operated device and is not isolated from ground. Powering the device under test using an isolation transformer is strongly recommended.

B.) Do not inadvertently short any part of the printed circuit card to ground, as severe damage will result.

FUNCTIONAL DESCRIPTION

The Masterflex digital pump drive/dispensers deliver accurate amounts of fluids at adjustable flow rates. The use of a microprocessor with an optical shaft encoder allows the user to obtain consistent flow rates with excellent speed regulation. The unit features permanently stored calibration data or empirical values (which are user entered) that are semi-permanently stored.

BLOCK DIAGRAM:



Barnant Co
847-381-7050 •
e-mail: barnan

ISO 9001 REGISTERED

As shown on the Block Diagram, the motor (pump) speed (w) is a function of the applied torque (T) acting on the rotor inertia (1/sJ). The torque in turn is proportional (Kt) to the armature current (Iarm), which is produced by the difference between the applied armature voltage (Varm) and the motor back EMF across the armature impedance (1/(Ra+s*La)). The motor back EMF, generated in the armature windings by the motion of the rotor magnetic field, is proportional (Kw) to the motor speed. The applied armature voltage (Varm) is the amplified (Kwreg) error signal between the speed reference command (wref) and the motor speed (wfdbk). The motor speed signal (Kfdbk) is supplied by the drive to the microprocessor using an optical sensor tachometer mounted on the motor.

The unit contains two P. C. Boards. The Main Control Board is mounted vertically on the left side of the unit in the console drives and parallel to the chassis base in the modular drives. The Main Control Board has four main areas: the microprocessor and its related circuitry, the remote I/O, the motor power bridge and control, and the power supply. The Display Board, containing two dual 7-segment LED displays and mounted on the front of the enclosure, is connected via a flat ribbon cable to the control board.

The membrane keypad, which also contains the annunciator LED's, is secured to the front of the enclosure with pressure-sensitive adhesive. There are three flat flex tails (switch, LED's, and static shield ground) connecting the keypad to the Display Board.

THEORY OF OPERATION

Motor

The pump is driven by a brush-commutated DC motor. The motor converts electrical energy into mechanical energy through the interaction of two magnetic fields. One field is produced by a permanent magnet assembly attached to the motor shell; the other field is produced by an electric current flowing through the armature windings. These two fields produce a torque that causes the armature to rotate. As the armature turns, the current is switched (commutated) among the windings to produce a continuous torque output. The back emf is an induced voltage produced by the relative motion between the permanent magnet field and the armature windings. This allows simple speed and torque control as the speed is proportional to the applied voltage, while the torque is proportional to the current through the motor. On the peristaltic pump drives, the speed of the motor is reduced through a system of gears to provide the speed required by the pump.

Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com

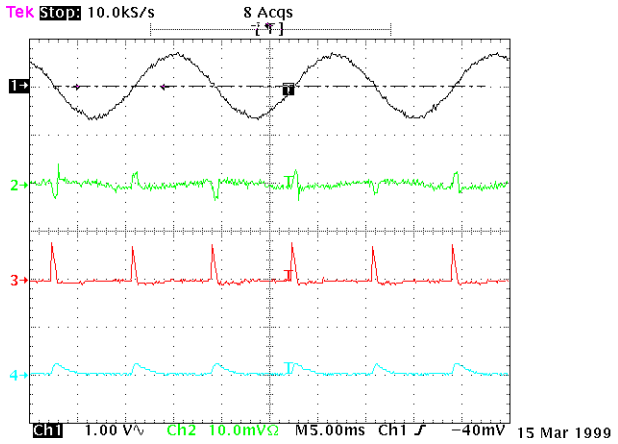
Phase-Controlled Rectifier Speed Control

The variable speed drive employs a phase-controlled rectifier bridge to vary the power applied to the DC motor. The bridge will only conduct current when the power line voltage exceeds the voltage across the motor terminals. The power to the motor can therefore be controlled by varying the point at which the bridge starts to conduct, relative to the phase of the line voltage. The phase angle at which the bridge starts conducting is controlled by a speed regulator loop. Synchronization to the power line is provided by a differential line cross comparator circuit U12A. Current and voltage waveforms for both the line and motor are shown for various load and speed variations.

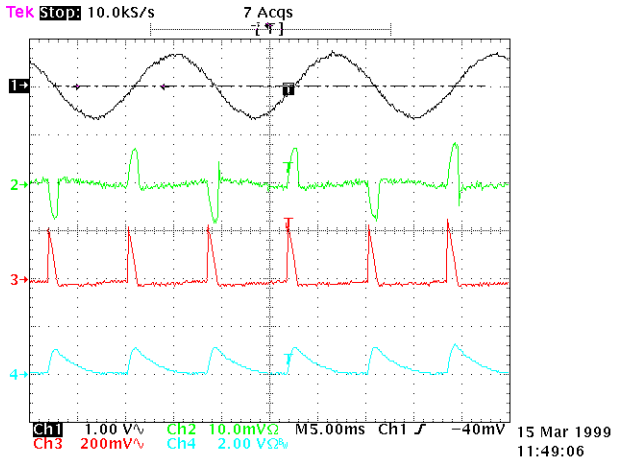
D32, D33, Q9, and Q10 form the main power bridge for the motor. D32 and Q10 conduct during one-half of the line cycle, while D33 and Q9 conduct during the other half. Reversals of the line voltage force the conducting SCR to commutate off. Since switching is at zero voltage during line cross, there is no flyback pulse from the motor to clamp. Opto-triacs U14 and U15 isolate the power line from the control circuits. RV1 and RV2 provide transient voltage protection from power line surges caused by other power conversion equipment and lightning strikes. RV1 and RV2 are in parallel with the transformer T1 primaries, which are selected between 115 Vac and 230 Vac operation with a line voltage selector switch SW1. Common mode choke L3 and line-to-ground capacitors C52 and C54 filter out conducted common-mode noise, while across-the-line capacitors C50 and C51 filter out conducted differential noise.

A dynamic brake resistor attached to the contacts of the ON/OFF relay (K2) brings the motor to a stop before reversing to avoid damage to the motor or drive.

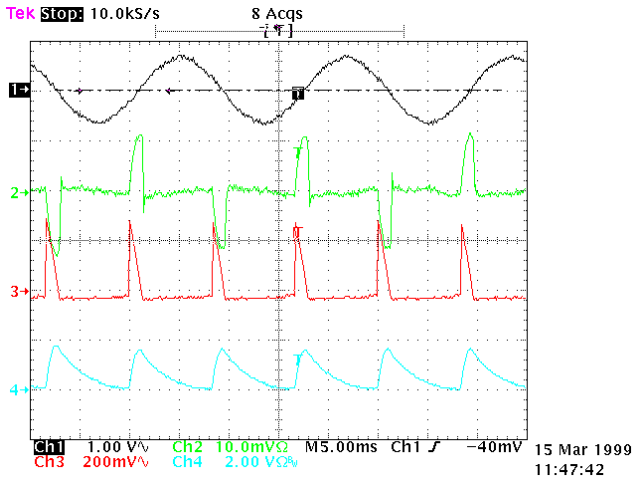
Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com



Low Speed
&
Low Torque



Low Speed
&
Med. Torque

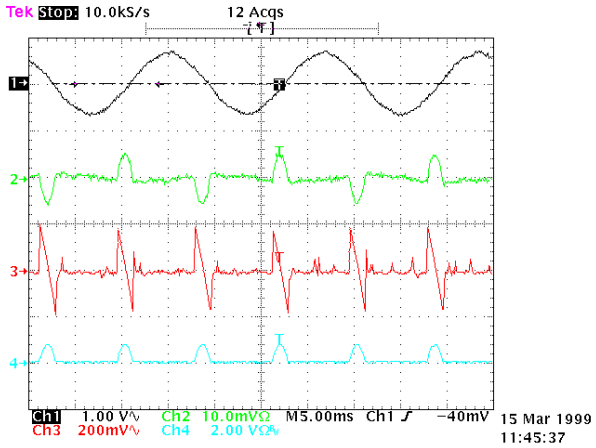


Low Speed
&
High Torque

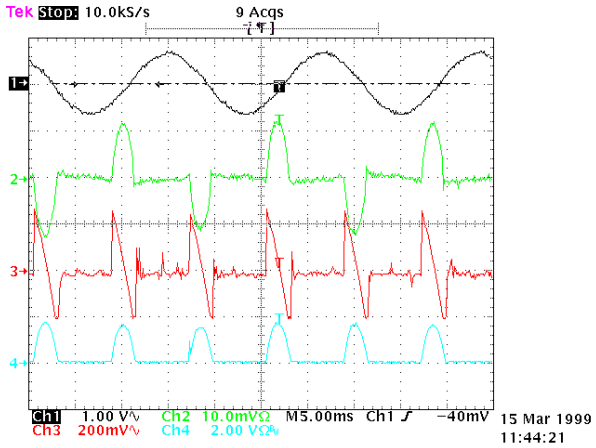
Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com

Cole-Parmer Instrument Company

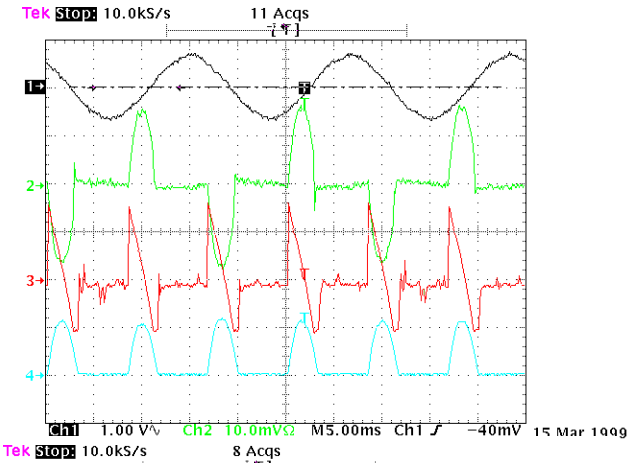
Manufactured by: **Barnant Company**



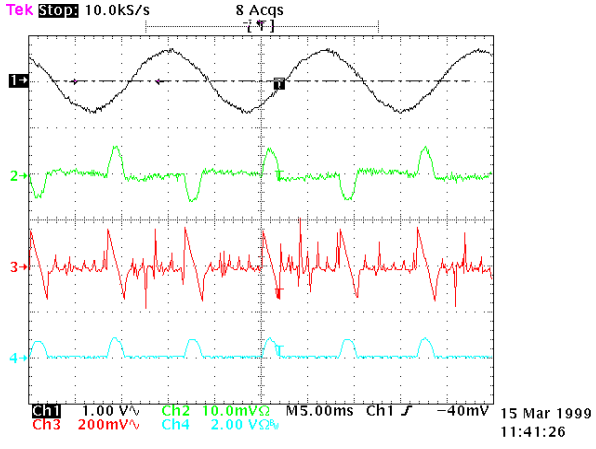
Med. Speed
&
Low Torque



Med. Speed
&
Med. Torque



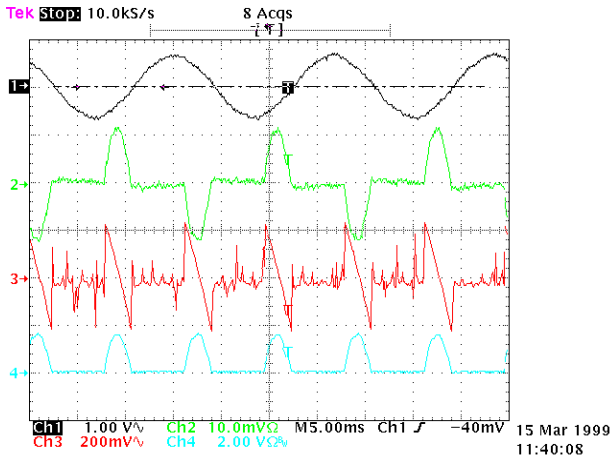
Med. Speed
&
High Torque



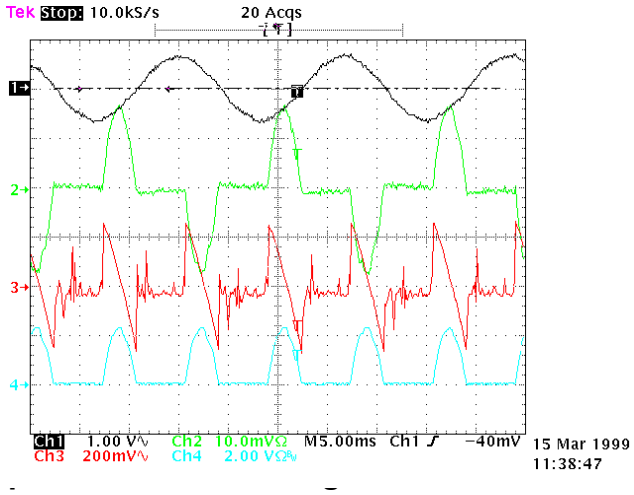
Barrington, IL U.S.A. 60010-2392

arnant.com

High Speed
&
Low Torque



High Speed
&
Med. Torque



High Speed
&
High Torque

Speed feedback is provided by a slotted encoder wheel and optical sensor. The IR output of the sensor diode is interrupted by slots in an encoder wheel attached to the motor shaft. The IR sensor output is filtered by C37, C67, and C66. The offset is removed by C68 and level shifted by R125 and R127. U12C compares the sensor output against the reference level formed by R94 and R126. R109 provides hysteresis

Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com

for noise filtering. Additional filtering is provided by C65 and C36. Transistor Q4 provides a buffered tachometer signal to the user.

The encoder pulses from the comparator output are counted by the microprocessor to determine the motor speed. Schmitt trigger U2E speeds up the slew rate of the comparator U12C output. The difference between the set speed and the motor speed is used by the microprocessor to determine the required phase angle to fire the output SCR's.

The interrupt service routine for the line cross interrupt reads the number of encoder pulses stored in the pulse accumulator register (PACNT), resets the PWM output, updates the copy/dispense counter, and sets the SCR firing angle. The speed error (speed_err) is the difference between the speed setpoint (control_ppi) and the actual speed (actual_ppi), derived from the number of pulses stored in the pulse accumulator register between line crosses. The speed error (speed_err) is integrated (intg_err := speed_err / 64 – intg_err * 1023). The integrator output (intg_err) and the speed error (speed_err) are then used to calculate a new SCR firing angle (fire_cnt := speed_err/2 + intg_err * 1024 + BUZZ_CNT). BUZZ_CNT is a constant minimum count (= 1365) needed to get the motor turning. Once calculated, the SCR firing angle (fire_cnt) is subtracted from the average count of the processor clock per line cross (avg_clks). This sum is then added to the existing counter value (TIC2) to generate the value of the counter at the time the counter output fires the SCR (new_cnts).

CPU Section

The CPU, U8, for the system is a Motorola MC68HC11D0. The CPU is operated from a crystal, Y1, at 9.8304 MHz. The RAM, ROM, data latch, and expanded I/O for the system are provided by a WSI PSD312, mounted in a socket, X1. Non-volatile memory for calibration and setup information is provided by the EEPROM, U6, which has a serial interface to the CPU. The 5V digital supply level is monitored by U7 to control the power-up/down reset of the CPU and the RAM/ROM/latch in the WSI PSD312 IC. The CPU contains an independent, on-chip watchdog timer.

Display/Keypad

The digital drives use a 4 character, 7 segment light emitting diode (LED) display for speed and flowrate information. Individual LED annunciators on the keypad show setup information. Display segments and LED annunciators are matrix addressed by a display driver chip, U1, which has a serial interface to the CPU. Current through the LED's is set by R9, while resistors R1 through R8 limit power dissipation through the driver chip. Ferrite beads on the output lines filter out EMI. Matrix addressed keypad

Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com

switch closures are read into an 8-bit parallel port on the WSI PSD312 chip. RC network R47 through R62 and C17 through C24 provide EMI filtering.

A/D Converter

The A/D converter, U5, is a 11 channel, 10-bit successive approximation converter with a serial interface to the CPU. The +5V supply voltage is filtered by R34 and C12 and used as a reference voltage for the A/D. The A/D is self-clocking with an end-of-conversion (EOC) signal to trigger a CPU interrupt. The address of the next channel to be converted is clocked in as the previous conversion result is being clocked out. Normally unused A/D channels are used to monitor the remote contact closure input status.

Analog I/O (0-10V & 4-20mA)

Speed can be controlled through either an external 0-10V or an external 4-20mA signal. The current signal is converted into a voltage for the A/D converter U5 by R15. Differential buffer amplifiers U4C (Current) and U4D (Voltage) eliminate errors caused by common mode voltages. Clamp diodes D1 and D3 protect U4C; D2 and D5 protect U4D, while D9 and D10 and resistor dividers R26 through R33 protect A/D U5 from over-voltages.

A PWM signal, proportional to motor speed, from pin 25 of the microprocessor U8 is low-pass filtered by a three pole Bessel filter, with a 10 Hz bandwidth, formed by U4B. The output is used for both an external 0-10V signal and a reference input for a voltage to current converter formed by U9A and U4A. Emitter-follower Q2 permits the output voltage to reach 0V.

The output voltage is converted into a current by voltage follower U9A, high-gain transistor buffer Q6, and resistor R97. The open-loop gain of U4A forces the voltage drops across R112 and the parallel combination of R113 and R98 to be equal. The currents through the resistor network are therefore proportional to the relative resistor values. Because of the high input impedance of U4A and the high gain of the Q3 and Q5 transistor combination, the external 4-20mA signal is the current through the parallel R113 and R98 resistor network.

Contact Closure Input (AUX IN, Remote Start/Stop, & Prime)

Resistors R11 to R13 and R72 are pull-ups for the contact closure inputs. Capacitors C4 to C7 provide low pass filtering for the signals. Diodes D12, D14, D16, and D18 and resistors R86 to R93, R149 to R151, and R46 protect against over-voltage transients.

Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com

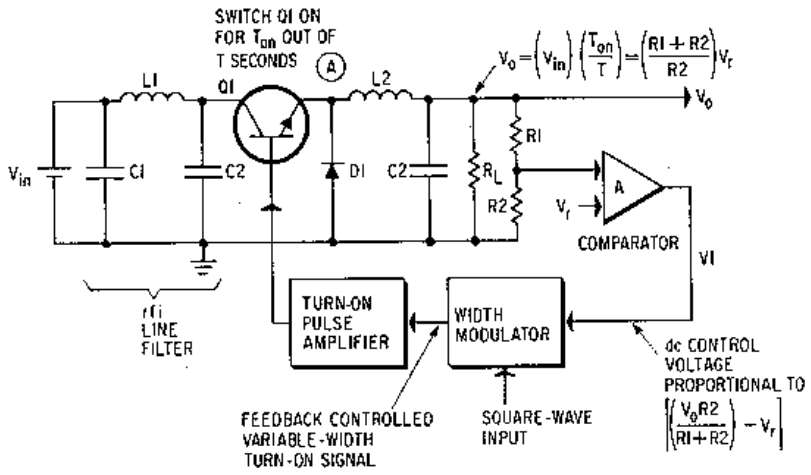
Power Supply

The primary power supply for the system is a 115 VAC or 230 VAC +/- 15%, 50 or 60 Hz, wall outlet. The rear panel power input module for the detachable power cord contains the fuse. Switch SW1 on the Main PCB selects between 115 and 230 Vac operation, so that the same PCB can be used for both voltages.

An unregulated +24 Vdc supplies power to the analog inputs and outputs, to the relays K1 through K4, and to the +5 Vdc switching regulator U13, which supplies power to the rest of the control circuits. The unregulated +24 Vdc is generated by filtering (C49) a full-wave rectified (D22-D25), center-tapped secondary winding output of T1. A double isolated transformer T1 is required to avoid ground loops and for safety, as the remote inputs and outputs might provide an electrical connection to an energized surface.

+5 V Switching Regulator

Shown below is a schematic representation of the U13, LM2594, +5Vdc switching regulator circuit. In the figure, C1 corresponds to C49, L1 to E24, C2 to C53 and C62, D1 to D27 L2 to L4, and C2 to C55 and C56. The remaining components are internal to U13. Circuit waveforms are shown in the figure following.



Basic step-down switching regulator.

Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com

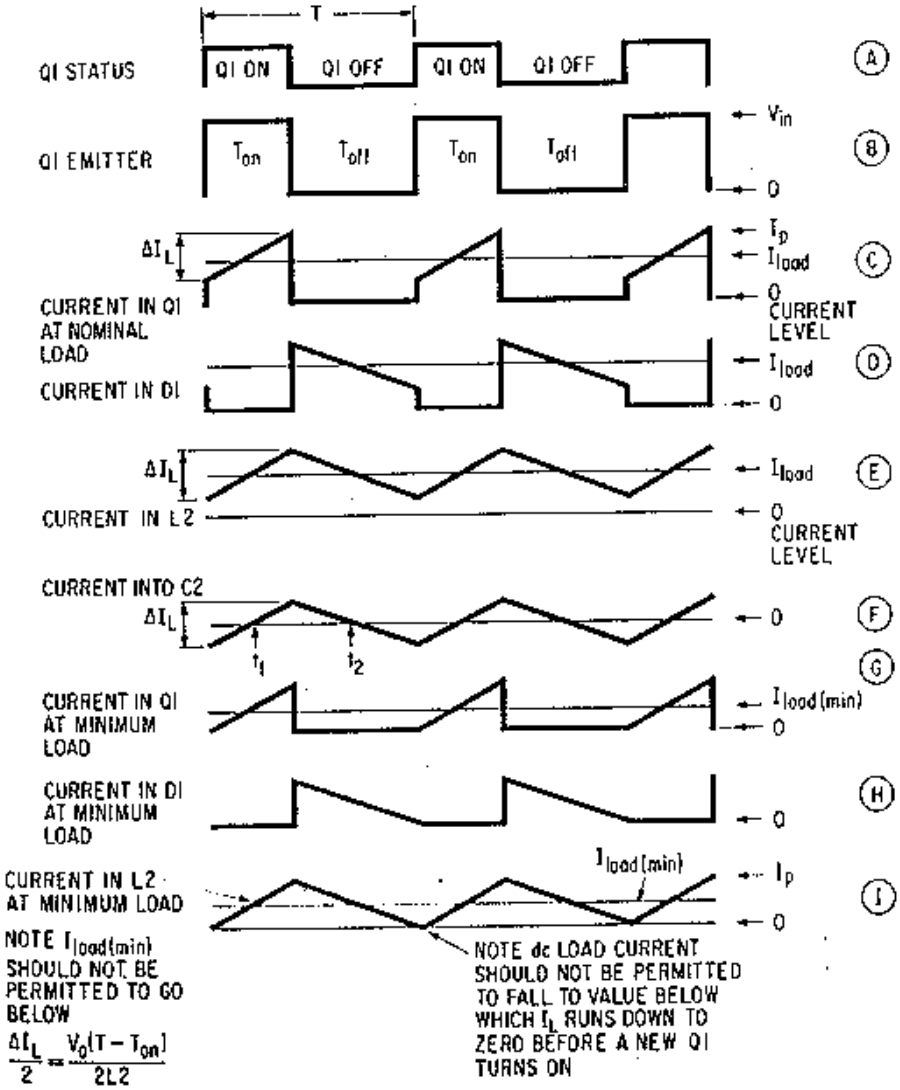
Waveform B is the voltage at point A in the schematic. It is at $+V_{in}$ for the time Q1 is closed (T_{on}) and at ground for the time Q1 is open ($T- T_{on}$). The filter L2C2 averages out the V_{in} peak-to-peak ripple voltage to produce a constant dc output voltage V_o whose value is given by:

$$V_o = V_{in} (T_{on}/T)$$

The LM 2594 regulator continually adjusts T_{on} to give a fixed +5Vdc output. The period T remains fixed at a switching frequency of 150 KHz. The ripple voltage on V_o is determined by the choice of L2 and C2. Waveforms C through F show currents through the switch Q1, diode D1, inductor L2, and capacitor C2. The average value of current through the inductor L2 must always equal the dc load current. The current through L2 ramps upward through Q1 when Q1 is closed and ramps downward through D1 when Q1 is open. The inductor current ramp must not be allowed to go to zero, placing a minimum limit on the allowable load current. When Q1 is closed, there is a constant voltage across L2 equal to $V_{in} - V_o$. Since the voltage across and inductor is given by V = L di/dt, the magnitude of the peak of the current ramp is given by:

$$\Delta I_L = (V_{in} - V_o) T_{on}/L2 .$$

Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com



Critical waveforms in the step-down switching regulator

TROUBLESHOOTING

Repairs on this unit are confined to either the unit's Main PCB assembly and/or drive motor assembly.

Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com

Where possible, swap known good parts to localize and isolate the problem. The following is a list of possible problems and remedies:

VERIFY AC POWER IS OPERATIVE.

MOTOR WILL NOT RUN, DISPLAY DOES NOT LIGHT:

1. fuse blown - replace fuse
2. power cord not connected properly - check & replace
3. AC power switch failure - replace switch assembly
4. unit connected to dead outlet - verify supply is HOT
5. power supply failure - replace main PCB assembly

UNIT BLOWS FUSES:

1. motor drive failure - check using known good motor
2. defective main PCB - replace main PCB assembly
3. wrong fuse installed - check fuse rating

MOTOR WILL NOT REVERSE:

1. defective main PCB - replace main PCB assembly
2. defective keypad - replace keypad

MOTOR WILL NOT RUN, DISPLAY LIGHTS:

1. defective keypad - replace keypad
2. defective main PCB - replace main PCB assembly
3. defective motor assembly - replace motor assembly
4. dirty encoder switch - clean switch & disk
5. wrong operating MODE - MODE set to INT for front panel operation, mA or V for remote operation

LOSS OF SPEED CONTROL, OR IMPROPER SPEEDS:

1. defective main PCB - replace main PCB assembly
2. dirty encoder switch - clean switch & disk

Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com

NO REMOTE OPERATION:

1. defective main PCB	- replace main PCB assembly
2. external cable not connected properly	- check/replace

DISPLAYED ERROR CODES

ERR = Bad calibration run
ERR1 = No encoder pulses, Motor undershoot
ERR2 = Motor overspeed, Motor overshoot
ERR3 = Not Used
ERR4 = Bad PROM checksum, program halted
ERR5 = Motor overload
ERR6 = Bad zero crossing detector or crystal
ERR7 = Bad EEPROM data, using operator parameter default values
ERR8 = Bad EEPROM data, using A/D calibration default values
ERR9 = EEPROM write/verify error

LOSS OF SPEED CONTROL, **ERROR #1** DISPLAYED:

1. motor undershoot (no tubing in pump)	- press any key to clear error
2. defective main PCB (encoder circuit)	- replace main PCB assembly
3. defective motor/encoder assembly	- replace motor assembly

MOTOR IMMEDIATELY RUNS WHEN POWER IS APPLIED, **ERROR #2** DISPLAYED:

1. motor overshoot (no tubing in pump)	- press any key to clear error
2. defective main PCB (power bridge)	- replace main PCB assembly

ERROR #4 DISPLAYED:

1. bad PROM	- replace PROM

MOTOR OVERLOAD, **ERROR #5** DISPLAYED:

1. pump jammed	- clear obstruction, turn drive off then on

Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com

ERROR #6 THROUGH **#9** DISPLAYED:

1. turn unit off then on and/or press any key to reset, if any error numbers reappear - replace main PCB assy.

NO DISPLAY OR GARBLED DISPLAY:

1. display connector not seated - reseat ribbon cable (J3)
2. display failure - replace display PCB assembly
3. defective main PCB (U1) - replace main PCB assembly

IMPROPER KEYPAD OPERATION:

1. keypad failure - replace keypad assy.
2. defective main PCB (PROM) - replace PROM / main PCB assembly

FOR ADDITIONAL INFORMATION REGARDING YOUR UNIT PLEASE REFER TO THE OPERATOR'S MANUAL.

REPAIR PROCEDURES

TO DISASSEMBLE UNIT, PROCEED AS FOLLOWS:

A) **Disconnect AC power.**
B) Remove the three (console drives) pan head screws on each side of the unit's cover. On NEMA drives, loosen the four captive screws in the cover.
C) Lift off cover assembly.

TO REASSEMBLE UNIT, PROCEED AS FOLLOWS:

Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com

A) Slide on cover assembly.
B) Install the three (console drives) pan head screws on each side of the unit's cover. On NEMA drives, tighten the four captive screws in the cover.

TO REPLACE MOTOR ASSEMBLY (Console Drives Only)***:***

A) Remove BLACK motor lead from J5.
B) Remove RED motor lead from J6.
C) Remove Motor Encoder Cable from J9.
D) Remove top nut holding GREEN ground wire to the chassis.
E) Remove four bolts holding motor to chassis.
F) Replace motor and tighten bolts. Attach leads and encoder cable.

TO REMOVE MAIN CONTROL PCB ASSEMBLY:

A) Console Drives: Remove two screws holding heat sink assembly to chassis. Remove screw from PCB Card Guide. Remove PCB Card Guide.
NEMA Modular Drives: Remove two nuts holding heat sink bracket to chassis. Remove two screws holding PCB to chassis. Remove two screws holding heat sink assembly to heat sink bracket.
B) Remove all cables and wires from PCB.

TO REPLACE PROM:

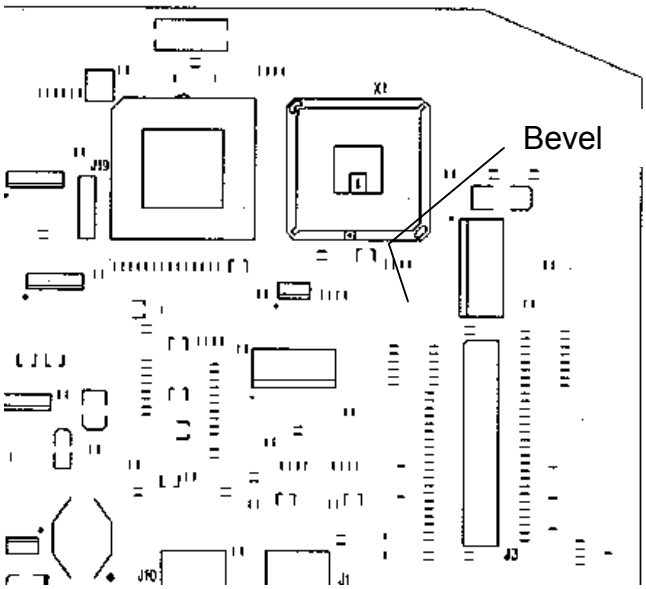
NOTE: The part is in a 44-pin PLCC socket, but requires an extraction tool to avoid damage to the socket and firmware chip. Recommended extraction tools are the OK Industries EX-5 and the AMP #821981-1.

NOTE: **To avoid ESD damage** to the firmware chip, leave the chip in its protective carrier until it is to be inserted. Wear an earth-grounded, anti-static wrist strap while working on the drive.

A) The socket, holding the firmware, is located in the upper right-hand corner of the Main PCB and is labeled X1 on the PCB silkscreen. Please note that the beveled corner of the firmware chip will be in the lower right-hand corner of the socket. (See Illustration.)
B) Place the extraction tool so that it is firmly seated in the socket and over opposite corners of the firmware chip. Squeeze the handle to extract the chip.

Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com

C) Making sure that the new firmware chip orientation is the same as that of the old, place the replacement firmware chip in the socket. Keeping the chip level, gently squeeze the chip into the socket until it is fully seated.
D) Drive setup information is in a separate EEPROM so that the drive will not need recalibration. An Err 7 message will initially appear that can be cleared by pressing STOP/START.



TO REPLACE MAIN CONTROL PCB ASSEMBLY:

A) Note that the correct firmware is installed. Follow the steps outlined in "TO REPLACE PROM".
B) Note that SW1 on the Main Control PCB is set for the correct line voltage (115 V / 230 V).
C) Note wiring of Main Control PCB as follows:
   1) BLUE of power line to: J2
   2) BROWN of power line to: J4
   3) BLACK of drive motor to: J5
   4) RED of drive motor to: J6
   5) GREEN/YELLOW from Chassis Ground to J18 (Not on some 115 Vac drives)

   6) Ribbon cable from Display PCB to J3
   7) Cable from Motor Encoder to J9
   8) Rear Panel DB-15 ribbon cable to J11
   9) Two BROWN of Dynamic Brake Resistor to J16 & J17

Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com

10) BLACK from AUX OUT 2 to J7
11) WHITE from AUX OUT 2 to J8
12) RED from AUX IN 1 to J1
13) GREEN from AUX IN 1 to J10
14) BROWN from AUX OUT 1 to J14
15) BLUE from AUX OUT 1 to J15

TO REMOVE DISPLAY PCB:

A)Remove 4 screws (console drives, 3 on NEMA modular drives) holding the PCB to cover.
B)Remove ribbon cables. The ZIF sockets release the keypad flex tails by sliding out.

TO REPLACE DISPLAY PCB:

A) Replace cables. The ZIF sockets secure the keypad flex tails by sliding in.

1) Ribbon Cable (26 conductor) from Main Control PCB J3.
2) LED (11 conductor) flex tail from Keypad J2.
3) Switch (7 conductor) flex tail from Keypad J3.
4) Shield ground flex tail from Keypad – Secured and grounded to Display PCB with screw.

B) Secure Display PCB with 4 screws (console drives, 3 on NEMA modular drives).

TO REPLACE KEYPAD:

A) Follow the steps outlined in "REMOVE DISPLAY PCB".
B) Peel keypad from cover.
C) Affix new keypad to cover.
D) Follow the steps outlined in "REPLACE DISPLAY PCB".

REPLACEMENT PARTS LISTING

The following is a list of stocked main control PCB assemblies, firmware, keypads, and motor/drive assemblies for all indicated models:

MODEL #	PCB ASSY	PROM (X1)	KEYPAD	MOTOR ASSY

Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com

75211-30	E-2231-0002	5750	5679	D-3078-0001
75211-35	E-2231-0002	5750	5679	D-3078-0002
75211-40	E-2231-0002	5753	5695	75211-42
75211-45	E-2231-0002	5753	5695	75211-47

The following list is commonly used parts applicable to the above model LISTINGS:

DESCRIPTION	BARNANT part #
Detachable power cord 115 Vac (USA)	B-3115 (C/P# 50001-68)
Detachable power cord 230 Vac (EUROPEAN)	B-2938 (C/P# 50001-70)
Display PCB Assy (Console Drive)	D-2974
Display PCB Assy (Modular Drives)	D-3224
Magnetic Coupler	A-3207
Brushes (Set of 2)	C/P# 7520-04
Brush Cap Holder	C/P# 7520-03
AC Switch w/Boot Console	5742

Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com

CALIBRATION

Due to the design of this product, there are no calibrations and/or adjustments to be performed other than set-ups performed by the customer. Calibration of the Analog I/O requires a special calibration fixture at the factory.

Additional technical specifications are available in the unit's OPERATORS MANUAL.

FUNCTIONAL TESTS

1.00 Test equipment required:

1.01 Contact Tachometer (C-P Cat. # 8203-50 or 8203-80)
1.02 Variac 115 VAC, 60Hz or 230 VAC, 50Hz appropriate for unit being tested.
1.03 Foot switch (C-P Cat. # 7595-42) or Remote Control (C-P Cat. # 7592-83)

2.00 TESTING:

2.01 Plug controller into the variac set to 115 volts ac or 230 volts appropriate for the unit under test.
2.02 Turn the controllers power switch to the **ON** position. Verify that all LED's, display segments, and decimal points illuminate.
2.03 Verifying each LED illuminates for **INT**, **mA**, and **V**, press the **MODE** switch to get to the **INT** mode.
2.04 Select any tubing size (not RPM), then press the **FLOW** key. The

Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com

displayed value should change.

2.05 Press the **CAL** key. Note that the annunciator LED next to the key is flashing. Press the **Gear Set** key to exit out of CAL.

2.06 Verifying the LED for each tubing illuminates, press the **tubing SIZE** switch to get the **RPM** display.

2.07 Verifying each LED illuminates for **mL**, **COPY**, and **SEC**, press the **DISPense/copy** key until none of the LED's is on.

2.08 Turn the drive **OFF**. While holding the **MODE** switch, turn the drive **ON**. Set the input to **4-20mA** (115 Vac) or **0-20mA** (230 Vac) with the increment (**^**) or decrement (**v**) keys. Press the **MODE** switch. Set the output to **4-20mA** (115 Vac) or **0-20mA** (230 Vac), with the increment (**^**) or decrement (**v**) keys. Press the **MODE** switch to get to the **INT** mode. Turn the drive **OFF** then **ON** after a wait of at least three seconds. Verify the **INT** and **RPM** indicators remain lit.

2.09 Press **START** and then press **^** until display reads the maximum setting. Using the hand tach, verify motor runs within the specified tolerance. NOTE: Motor should be rotating CW when viewed from the front.

2.10 Press **v** until display reads the minimum setting. Using the hand tach, verify motor runs within the specified tolerance.

Drive	Maximum Speed			Minimum Speed		
	Setting	Max.	Min.	Setting	Max.	Min.
75211-30, -35, -40, -45	3600	3618	3582	60	69	51

2.11 Press and hold the **PRIME** key while noting that the drive runs at full speed.

2.12 Press the *Remote Start/Stop* (NEMA drives only) or foot switch. Verify that the drive runs as long as it is held. Press **STOP/START.**

2.13 Press the *Remote Prime* switch (NEMA drives only). Verify that the drive runs at full speed as long as it is held.

2.14 Turn the controller **OFF** and unplug it from the variac.

****

TESTS COMPLETED

****

Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com

ASSOCIATED DOCUMENTS

Current copies of the following documents are required for servicing the drive:

Main PCB Schematic:	E-2229
Main PCB Assy Dwg:	E-2231
Console Drive Display PCB Schematic:	D-2972
Modular Drive Display PCB Schematic:	D-3035
Operator's Manual:	
75211-30/35:	A-1299-0853
75210-40/45:	A-1299-0854

The following documents may be of help and are included for reference:

Chassis Assy Dwg:

75211-30/35:	5745
75210-40/45:	5739

Cover Assy Dwg:

75211-30/35:	5744
75210-40/45:	5740

Barnant Company • 28W092 Commercial Avenue • Barrington, IL U.S.A. 60010-2392
847-381-7050 • 800-637-3739 • 847-381-7053 (Fax)
e-mail: barnant@barnant.com • Web Site: http//www.barnant.com